AIR QUALITY STUDIES
in the vicinity of
THUNDER TILE LIMITED,
ROSSLYN

1982

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INTRODUCTION

Until the end of 1981, Thunder Tile Limited operated a brick and tile manufacturing plant in Rosslyn Village, on the western outskirts of the City of Thunder Bay. Air quality studies conducted since 1977 by the Ministry of the Environment (1, 2, 3, 4, 5) showed that sensitive garden vegetation in a nearby residential area sustained minor injury from airborne fluoride emitted from the tile plant. Airborne fluoride levels above acceptable limits were also recorded around the plant.

In December, 1981, the tile plant ceased production for economic reasons. To document conditions following plant shutdown, vegetation studies and measurements of airborne fluoride were continued in 1982.

VEGETATION EFFECTS

VEGETATION INJURY

As in previous years, no fluoride injury symptoms on indigenous vegetation were observed near Thunder Tile. Symptoms of old fluoride injury were noted on one-year-old foliage of planted jack pine (Pinus Banksiana) trees along the north boundary of company property on Rosslyn Road. Although injury was observed on current growth of red pine (Pinus resinosa) foliage in 1981, no injury was noted on the same needles (now one-year-old) in 1982. Needle loss between the two surveys may have been responsible for apparent improvement. Current (1982) foliage of both tree species was free of fluoride injury symptoms. Trace to light defoliator insect damage was observed on foliage of trembling aspen (Populus tremuloides) and black ash (Fraxinus nigra).

In contrast to preceding years, no fluoride injury was observed on fluoride-sensitive plants in residential gardens. A test plot of potted "Snow Princess" gladioli, 130 m (metres) north-northwest of the tile plant, was also free of visible

injury. In years when the tile plant was operating, this fluoride-sensitive gladiolus variety had shown fluoride injury symptoms during every growing season.

FLUORIDE LEVELS IN VEGETATION

On August 31, single samples of trembling aspen foliage were collected for fluoride analysis from 9 sites around the tile plant (Figure 1) and from two control sites remote from the study area. Standard Ministry sampling and analytical procedures (6) were followed. The data summary (Table 1) clearly shows that fluoride levels fell to normal in 1982, after the tile plant ceased production. Chemical analysis data and injury ratings for pine foliage (Table 2) show a similar effect. All forage (grass) samples from two locations in a farm pasture west of the tile plant (Figure 1) had fluoride levels less than 5 µg F/g, well below the maximum acceptable limit of 80 µg F/g.

Test plot gladioli, harvested on September 2, 1982, demonstrated normal fluoride concentrations in 1982, in contrast to the elevated readings found in previous years (Table 3).

AIRBORNE FLUORIDE LEVELS

EXPERIMENTALLY EXPOSED MOSS

Samples of dried Sphagnum moss in open-mesh polypropylene bags were exposed from July 13 to August 31 at 9 sites near the tile plant (Figure 1) and at two control sites remote from the fluoride source. The 1982 fluoride levels (Table 4) were very low and well below concentrations recorded when the plant was operating.

FLUORIDATION RATE

Lime candles record average fluoride levels in air during specified exposure periods. The measurement principle is described in a previous report (2). Monthly readings for 1978-81 and 1982 are reported in Table 5 for six monitoring locations (Figure 2) around Thunder Tile Limited. Unlike preceding years, fluoridation rates in 1982 never approached the maximum acceptable limit and were typical of low pollution areas.

SEVERITY INDEX RATING

The "Severity Index Rating" (7) for Thunder Tile in 1982 was zero, compared with an average of about 50 during the years in which the plant was operating. The index is based on fluoride injury symptoms and fluoride content of vegetation foliage.

SUMMARY

In the area around the Thunder Tile plant in Rosslyn, no new vegetation injury caused by fluoride was recorded in 1982. Fluoride levels in 1982 vegetation foliage was normal. This situation contrasts with that found from 1978-1981, when fluoride emissions from Thunder Tile resulted in minor vegetation damage and high fluoride levels in vegetation foliage. Airborne fluoride, as measured by lime candles and Sphagnum moss, also declined to normal concentrations. This dramatic improvement is attributed to the closure of the tile plant at the end of 1981.

If production resumes at Thunder Tile, the company will be required to meet fluoride emission regulations. To ensure compliance, the Ministry would then reactivate its monitoring program, which was discontinued at the end of 1982.

REFERENCES

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6. Ontario Ministry of the Environment. 1983. Field investigation procedures manual. Phytotoxicology Section, Air Resources Branch.

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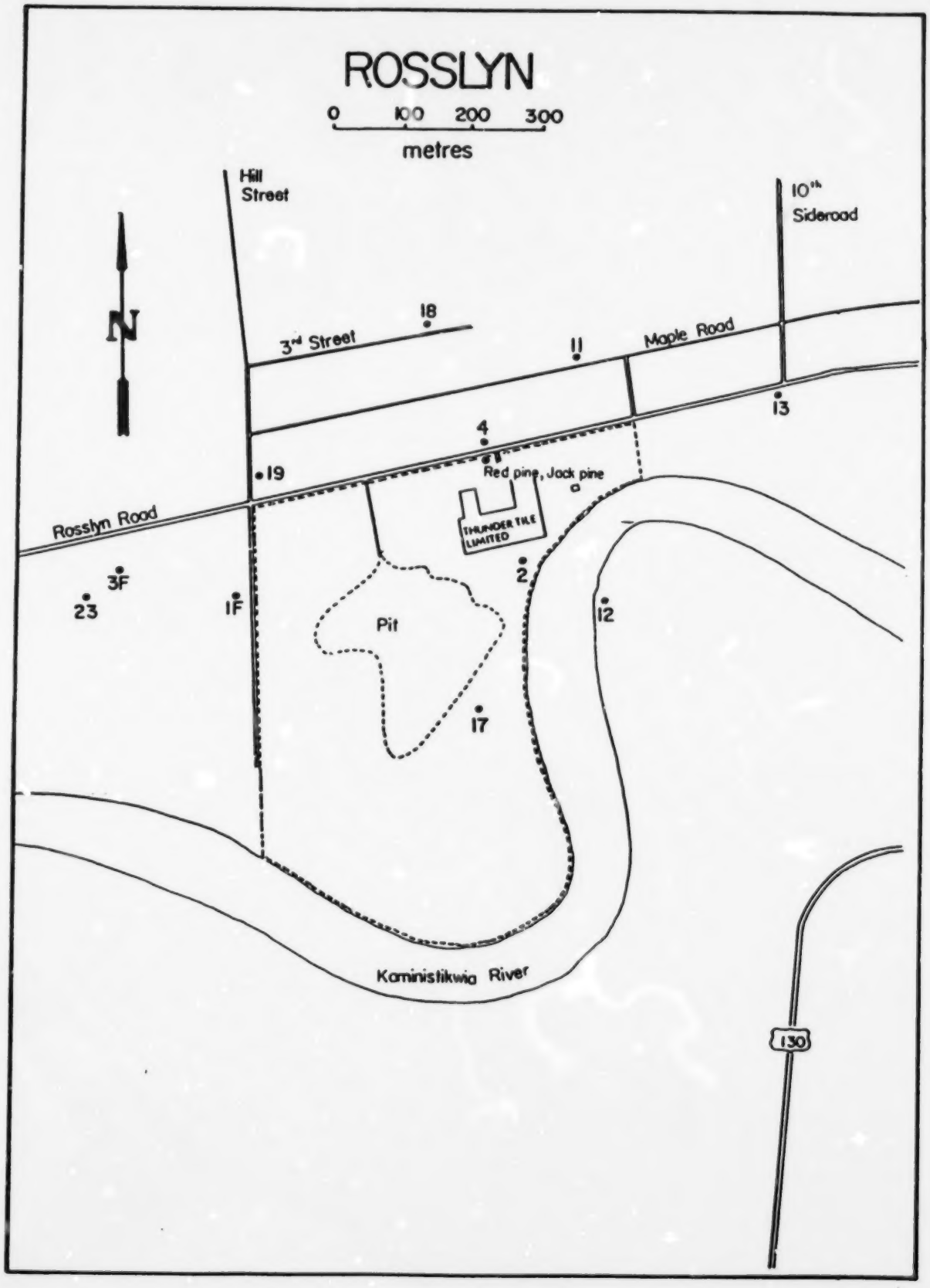

Figure I. Vegetation sampling sites, Rosslyn, 1982.

(Sites 2-23 represent trembling aspen and moss bag exposure sites. Sites IF and 3F are forage sampling points).

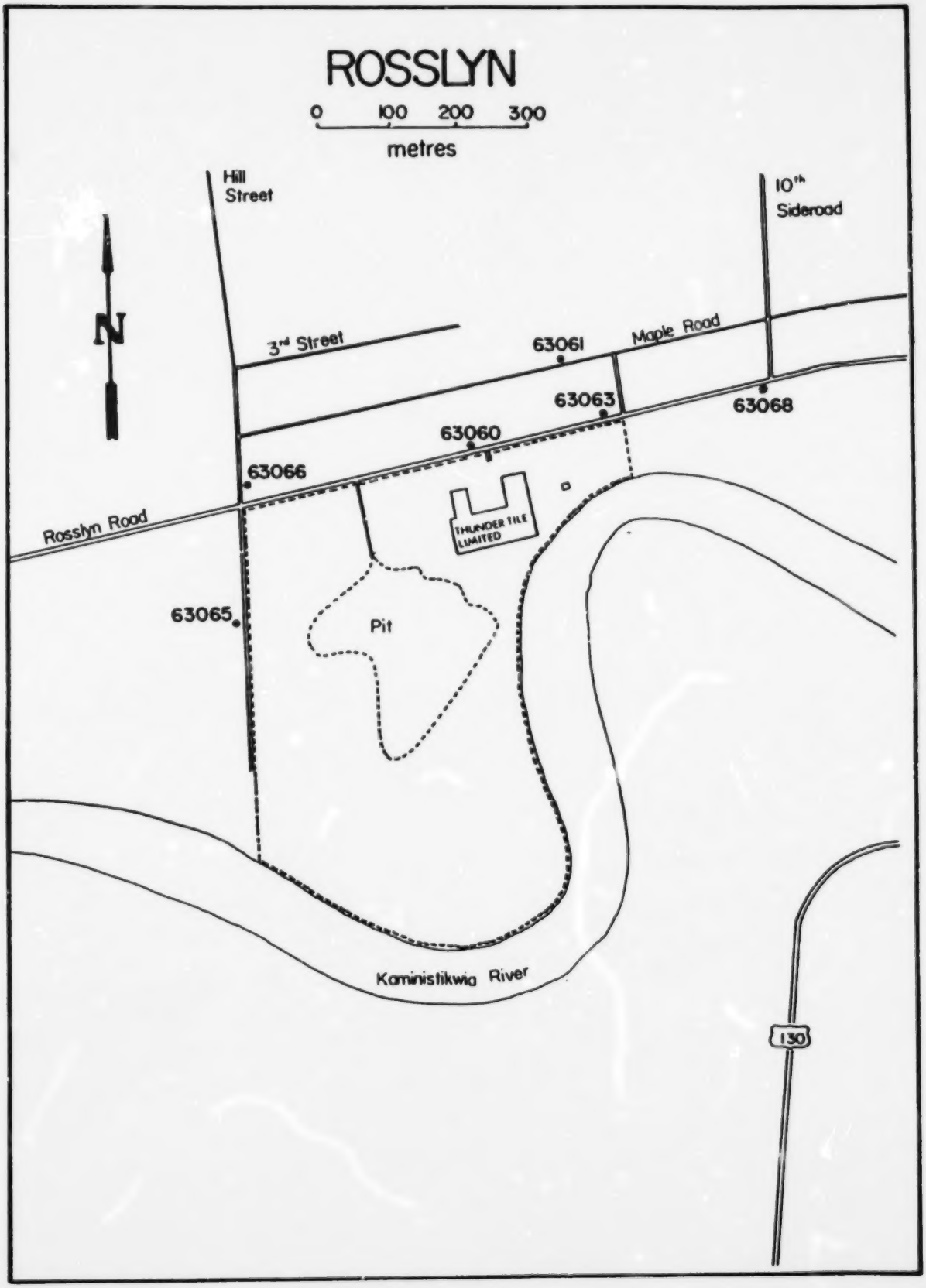

Figure 2. Lime candle monitoring sites, Rosslyn, 1982.

TABLE 1. Levels of fluoride (µg F/g, dry weight) in trembling aspen foliage, Rosslyn Village, 1978-81 and 1982.

Station	1978-1981 (average)	1982
2	260	<5
4	180	<5
11	96	<5
12	96	<5
13	18	<5
17	27	<5
18	24	<5
19	30	<5
23	27	<5
Controls	<5	<5

TABLE 2. Fluoride injury and concentrations (µg F/g, dry weight) in pine foliage sampled near Thunder Tile Limited, August, 1981 and August, 1982.

Sampling site	Tree species	Current foliage		One-year-old foliage	
		Injury	Fluoride	Injury	Fluoride
		1981			
2	Red pine	Moderate[a]	79	Moderate	190
Control	Red pine	None	4	None	12
2	Jack pine	Light	46	Severe	46
Control	Jack pine	None	9	None	10
		1982			
2	Red pine	None	<5	None	22
Control	Red pine	None	<5	None	<5
2	Jack pine	None	<5	Severe[b]	32
Control	Jack pine	None	7	None	<5

[a]Trace = 0-1% dead tissue, light = 2-10%, moderate = 11-35%, and severe = more than 35%.

[b]Injury may have been caused by stress during preceding winter.

TABLE 3. Fluoride concentrations (µg F/g) dry weight) in gladiolus foliage, 1978-1981, and 1982.

	Distance (metres) and direction from brick plant)			
	1978-1981 (mean)		1982	
	135 m NNW	Control	135 m NNW	Control
Top[a]	140	5	5	<5
Bottom[b]	18	<5	<5	5
Whole leaf	27	5	<5	<5

[a]Top half of foliage sample.

[b]Bottom half of foliage sample.

TABLE 4. Levels of fluoride (µg F/g, dry weight) in experimentally exposed moss, Rosslyn Village, 1979-80 and 1982.

Station	1979-1980 (average)	1982
2	190	9
4	260	11
11	93	12
12	84	10
13	74	10
17	39	5
18	64	8
19	44	14
23	58	10
Exposed control	17	5
Unexposed control	13	7

TABLE 5. Fluoridation rates (µg F/100 cm^2/30 days), Rosslyn Village, 1979-81 and 1982.

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
	1979-81 (average)												
63060	17	43	79	137	249	303	276	214	94	134	61	65	139
63061	12	22	10	83	111	195	185	146	50	70	45	21	79
63063	9	26	41	56	83	186	174	84	92	55	135	56	83
63065	13	125	140	124	118	92	37	23	15	29	39	18	64
63066	6	24	25	40	48	41	31	22	14	25	20	16	26
63068	10	14	21	21	46	72	61	33	22	21	42	22	32
	1982												
63060	16	11	8	7	9	7	7	12	1	3	1	1	7
63061	12	9	8	4	6	6	7	9	2	2	2	2	6
63063	11	7	7	4	5	5	6	<1	1	2	2	2	4
63065	6	<6	7	4	6	4	5	<1	1	2	1	1	3
63066	6	<6	6	4	5	3	4	<1	1	3	<1	<1	3
63068	<6	<6	6	4	6	6	4	-	2	3	<1	1	4

[a]Values exceeding air quality objectives of 40 µg F (May-September) and 80 µg F (October-April) are underlined.